Saskatchewan Ministry of Agriculture

RESEARCH

FINAL REPORT

ADF

AGRICULTURE DEVELOPMENT FUND

20050709

BUILDING BETTER LAMBS

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Building Better Lambs
Project # 20050709
Final Report

Submitted By Gord Schroeder

Summary
The Lakeland Carcass Sire project has been the most ambitious project under the Building Better Lambs Initiative – a collaborative effort by the western lamb supply chain to improve product consistency and quality.

The project management and its stakeholders solved innumerable problems to keep the project operating and, to finally complete it. Problems such as changes in upper management or staff in all stakeholder groups.

A significant problem was the low level of flock management at the College. This reduced the number of lambs available for the data set. Flock health issues that year impacted data quality. A management review was undertaken, a farm manager was hired and the existing flock was replaced. This third year supplied the numbers necessary.

The success of the project in many ways was illustrated by year three: lower lamb deaths, uniform weaning groups, larger and fewer groups of lambs shipped to Sunterra and consistent lamb data.

Project successes have been many. Not the least was to have completed the project. However, a key stakeholders statement that the project 'has exceeded our greatest expectations' is perhaps the most telling summary I can add. Secondly the fact that so many groups worked together on this project and were successful is encouraging for future projects.

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Tangible Outcomes:

Primary outcomes – high value lamb production information

- In-depth and current information on the five most commonly used terminal sires in the western lamb market
- Awareness of the value to both producer and processor of having improved and consistent carcass / yield data to work with
- A large and unique data set with which to build industry models to improve lamb production and returns to the lamb supply chain
- Electronic technology systems offer management potential

Secondary outcomes – lamb supply chain development

- Understanding that each link of the supply chain has an impact on the quality of lamb produced for the high value lamb market
- Awareness that lamb quality can be improved through better communication and focused effort by the entire supply chain
- Development of improved working relationship between key stakeholders of the western lamb supply chain

Outcomes –Lakeland College

- Improved flock production model at Lakeland College
- New 'Legacy Flock'
- Student exposure to leading-edge production, technology and high value lamb production

New sheep facility, increased student enrolment in program

Lakeland Carcass Sire Project Highlights 2004 / 2005 / 2006 / 2007 / 2008 / 2009

February 2004 – Grading issues / carcass variability discussions

- Sue Hosford/Randy Smith/ Ian Clark/ Kim Stanford
- Concepts of premium pricing grid and carcass sire study

June 2004 – Initial meeting: Lakeland College / AAFRD at Camrose

Winter 2004 – Project planning

- Media release(Lakeland College gears up for sheep research)

February 2005 – Stakeholder update

March 2005 – Applied for DFLOA and ACAAF funding

Spring 2005 – Collected sheep industry support (letters, cash, in-kind)

April 2005 – Funding approved
- Stakeholder and newsletter updates

May 2005 – First steering committee meeting at Lakeland College

June 2005 – Stakeholders sign MOU
- LCS Quarterly reports to ASWC (DLFOA/ACAAF)

July 2005 - Eligible rams selected and delivered
- LC working committee meeting

August 2005 – Start of breeding
- Open House, Lakeland College
- Steering committee meeting Vermilion

September 2005 – Media release (Boy meets girl at Lakeland College)
- LCS Quarterly reports to ASWC (DLFOA/ACAAF)

October 2005 – Allflex Canada donates RFID tags for traceability

November 2005 – Proposal to expand project to include sensory testing of project lambs
- Interim report DLFOA / ACAAF – approved
- LCS presentation Alberta Sheep Symposium, Red Deer

December 2005 – LCS Quarterly reports to ASWC (DLFOA/ACAAAF)

January 16, 2006 – First lambs born at Lakeland College
- Request for change approved: increase ram purchase price for 2006 to $500 from $300
- Saskatchewan update
- Alberta Sheep update

February 2006 – Saskatchewan Sheep Development Board with additional funding from the Saskatchewan Ministry of Agriculture joins as major stakeholder
- Steering committee meeting, Camrose
- Project posted on RTW

March 2006 – First year report DLFOA / ACAAF - approved
- Steering committee meeting Vermilion
- DFLOA application for Sensory Testing trial

April 2006 – Alberta Sheep update
- LCS Quarterly reports to ASWC (DLFOA/ACAAAF)

May 2006 – Approval by DLFOA for Sensory Testing trial phase one

June 2006 – First load of lambs to Sunterra
- Stakeholder / producer update
- Steering committee meeting Vermilion

July 2006 – Lakeland College ewe flock replaced
- Media release (The terminal sire effect – only skin deep?)
- Two loads of lambs to Sunterra

August 2006 – Last load of lambs to Sunterra
- Eligible rams selected and delivered, breeding soundness and semen evaluations completed
- Construction starts on new Lakeland College sheep barn
- LCS Quarterly reports to ASWC (DLFOA/ACAAAF)

September 2006 – Start of breeding
- Alberta Sheep update
- Working committee meeting Vermilion
- Request for change approved: third year funding

October 2006 – First year data submitted for analysis
- Stakeholder / producer update
- Request for change approved: ram rental
- DFLOA application for third year extension

November 2006 – Sensory testing of lamb at Lacombe
- Interim report for DLFOA / ACAAF - approved
- Applications to AA&F (Livestock Products Theme) for funding for: 3rd Year LCS; second phase of Sensory testing; (Traceability Initiative) practical application of traceability systems for lambs, birth to carcass grading – Hosford, Giffin; (Beef Theme) reducing variation in tenderness using lamb model – Markus, Basarb

December 2006 – Sensory data analysis and review
- SK Sheep Shape update
- LCS presentation to SSDB annual general meeting; to CSF annual general meeting
- LCS Quarterly reports to ASWC (DLFOA/ACAAAF)
- DLFOA approval of ½ 3rd year funding; forwarded to ACAAF

January 2007 –
- LC working committee meeting Vermilion (Tracy's report)

- Completed final report for DLFOA on LCS Sensory trial phase one (Gibson, Aalhus)
- Completed annual report for DLFOA/ACAAAF on LCS Year one (Gallivan, Carom)
- Presentations to Olds College / Lakeland College students
- First year data analysis completed

February 2007 –
- Construction finished on Lakeland College sheep facility
- Year 2 sensory trial cancelled
- Interim report to DLFOA / ACAAF
- Second-year lambing starts

March 2007 –
- Stakeholder and industry update
- Steering committee meeting Vermilion
- Q4 Report - AAF Theme
- Ram contributor survey
- Ram selection committee meeting

April 2007 –
- LC working committee meeting Vermilion
- SM working committee meeting Innisfail
- Report to ASWC Board of Directors
- LCS Quarterly report to ASWC
- Preliminary results article (Gallivan)
- Letter to DLFOA re cancellation of sensory trial

May 2007 –
- Preliminary results article posted on RTW
- Update in Alberta Sheep newsletter
- Financial tracking meeting Airdrie – Margaret /Sue
- Bob Comfort visit

June 2007 –
- First load of lambs to Sunterra
- Preliminary results article in Sheep Canada magazine
- Q1 Report – AAF Theme
- Invitational session for LCSP grading committee – Lacombe

July 2007 –
- World Sheep and Wool Congress Mexico (Hagedorn)
- Presentation to Ontario Large Flock Owners (Hosford)

August 2007 –
- Steering committee meeting Innisfail

- LCS Quarterly report to ASWC
- Project update – Alberta Sheep newsletter
- New ewes arrive

September 2007 –
- Last load of lambs to Sunterra
- Rams in for last breeding season
- Presentation to Lakeland students
- Q2 Report – AAF Theme
- Second year data submitted for analysis

October 2007 –
- Open House and ribbon-cutting for college sheep facility

November 2007 –
- Project presentation at Alberta Sheep Symposium
- Rams dispersed

December 2007 –
- Q3 Report - AAF Theme
- Tax credit forms mailed

January 2008
- LC working committee meeting Vermilion
- Pregnancy scanning
- Micotil trial
- Open House article in AB Sheep Newsletter
- Open House article on RTW

February 2008
- Third year lambing starts
- Hired students to care for over 100 bottle-fed lambs
- Lambing process very much improved over year one, death losses significantly reduced

March 2008
- Photo essay in Western Producer
- Second preliminary results article on RTW
- Weaning groups very consistent and uniform

April 2008
- Blood drawn for OPP testing – significant number of positive results
- College ewes sent to auction for slaughter
- Second preliminary results article in Sheep Canada magazine

May 2008

- LC working committee meeting Vermilion
- Stakeholder survey on final results key messages to industry
- Feeder lambs doing very well, groups very consistent, orphans most inconsistencies

June 2008

- Lakeland College signs co-operator 'Working Agreement' with Lamb Traceability Pilot project
- Ewes purchased for legacy flock (Lang / MB; Bendixen / AB)

July 2008

- July 8 first load of lambs to Sunterra
- First lot of the project where lamb RFID numbers scanned onto carcass tags. Lambs electronically traceable from conception to retail cuts. Test electronic system worked, now to automate under the Lamb Traceability Pilot project.
- Sue presentation / display booth at Grassland Sheep Symposium, Drake, SK

August 2008

- Last load of lambs to Sunterra
- Bendixen ewes arrive

September 2008

- Wade Meunier contracted to do financial analysis

October 2008

- Bendixen ewes – RF ID tagged / entered into management software
- Conference calls with Cathy and Wade on handling results
- Sue presentation to CSF annual general meeting, Moncton, NB

November 2008

- LC steering committee meeting Airdrie, invited guests to celebrate successful completion of the project
- Communication committee formed

December 2008

- Lang ewes arrive
- Barb Vanden Bosch hired as facilitator for communication committee.

January 2009

- Lang ewes RF ID tagged, entered into management software
- Communication committee meeting and conference calls
- Review of stakeholder survey on final results key messages to industry
- Decision on 'key messages'/ draft process for advocacy and communication
- Barb Vanden Bosch completed contract

February 2009

- Meeting in Adrie
- Communications committee conference calls
- Receipt of Gallivan / Meunier reports
- Final reporting for project:

REPORT ON THE LAKELAND CARCASS SIRE PROJECT

C. Gallivan, PhD, Technical Research
Susan Hosford, Project Manager
February 6, 2009

INTRODUCTION

In 2004 Sunterra Meats approached Alberta Agriculture over the issue of lamb inconsistency and carcass variability impacting the expansion of sales into the high value lamb market. High value Canadian markets had been targeted as potentially being able to increase returns to the lamb supply chain. These high value markets required not only a consistent supply but also consistently high quality lamb. With consistent quality Canadian lamb could readily replace imported product.

Members of the lamb supply chain agreed to begin to work together with a goal of reducing inconsistencies in quality, of increasing returns across the supply chain and of expanding western lamb production. A multi-pronged approach was seen as complex, but essential to making progress:

- consistent grading to identify the quality of lamb required by high value lamb markets
- a pricing grid incentive for lambs meeting targets for weight, fat and muscling
- a carcass sire trial to address gaps in information needed to produce high quality carcass lambs
- improved exchange of information between western lamb supply chain stakeholders

In 2005 funding was approved for the project for two years. In October 2006 an application was made to extend the project for one more year in order to have enough lambs to validate the data collected. This then is the report of the Lakeland Carcass Sire project – year three.

BACKGROUND

When new sheep producers look for advice about which breeds of sheep to raise, they often get conflicting answers. Commercial producers usually recommend breeds that are reproductively efficient (maternal breeds) because these breeds help them control their cost of production by spreading input costs over a larger number of market lambs. Lamb processors, however, are likely to recommend breeds that are most profitable from their

point of view – those that are perceived to have higher dressing percentages, or leaner or better muscled carcasses. These breeds are known as terminal sire breeds.

Over the last 30 years in Canada, a great deal of extension has been done to encourage producers to combine the best attributes of maternal and terminal sire breeds in their flocks. Terminal sire breeds grow faster to slaughter weight than do maternal breeds. But they are also larger, require more feed and produce fewer lambs than maternal breeds, making them ill-suited as a genetic base for a commercial ewe flock. But when rams of terminal sire breeds are mated to ewes of maternal breeds to sire lambs that are slaughtered for meat, producers can improve the growth and carcass attributes of their market lambs without adverse effects on the reproductive performance of the ewe flock. Although the use of terminal sires has been adopted by many long-term sheep producers, there are still many flock owners in Canada who do not know what a terminal sire is.

The most common terminal sire breed in Canada has traditionally been the Suffolk. Lamb markets in Canada have traditionally been based on live weight, and have not provided an incentive for breeders of terminal sires to select for traits beyond growth rate. When lambs are marketed on a live weight basis, lambs that grow the fastest cost the least to produce, and the superiority of the Suffolk (and the Hampshire) for growth rate has been well-documented in test stations across Canada.

In the last ten years, however, processors in several parts of the country have begun purchasing lamb carcasses rather than live lambs. Lambs are delivered to the plant for slaughter and payment is made on their hot carcass weights, with adjustments for leanness (GR measurement) and muscularity (subjective visual carcass conformation scores). This development stimulated an interest in Suffolk breeders in measuring more than just growth rate in their sheep, and many have made use of ultrasound to assist them in selecting animals with less fat and more lean.

New sources of terminal sire genetics have also become available. In the late 1980s the federal government released the newly-developed Canadian Arcott breed to the sheep industry, and the first imports of Texel sheep arrived from Europe. Imports of Charollais and Ile de France (also from Europe) followed in the 1990s, assisted by the availability of artificial insemination and embryo transfer technology in Canada. Canadian lamb producers suddenly had a choice of more than just Suffolks or Hampshires to meet their terminal sire needs, and producers and processors were looking for answers about which terminal sire breeds would best suit their requirements.

OBJECTIVE

The objective of this project was to compare the ability of five terminal sire breeds of sheep (Canadian Arcott, Charollais, Ile de France, Suffolk and Texel) to meet the needs of commercial lamb producers and lamb processors in the province of Alberta.

MATERIALS & METHODS

Scope of Project

Rams of the five terminal sire breeds were mated to commercial ewes in the Lakeland College ewe flock to produce lambs that were 50% Canadian Arcott (CAN), 50% Charollais (CHR), 50% Ile de France (IDF), 50% Suffolk (SUF) or 50% Texel (TXL). Ewes were wintered, and lambs were born, weaned and fed to market weight at the college. From there they were transported to Sunterra Meats in Innisfail for slaughter, grading and processing into retail cuts.

This study was originally designed to be run over two years, starting with the breeding season in the fall of 2005 and ending with the slaughter of the 2007 lamb crop in the fall of that year. As a result of a serious outbreak of sheep footrot in the college ewe flock in the spring and summer of 2006, the entire flock of mixed Suffolk, Dorset, Romanov and Rideau Arcott breeding was culled and replaced with a group of commercial white-faced range ewes of Rambouillet and Columbia breeding, in time for the 2006 breeding season. The age of the white-faced range ewes was unknown but all were at least four years of age. The footrot that affected the ewe flock also had a severe deleterious effect on the performance of the 2006 lamb crop. Although the lambs were slaughtered and carcass data collected as planned, it was decided to extend the study for a third year and eliminate the data from the first year in the final analysis.

Rams

Fifty purebred rams from Alberta, Saskatchewan and Ontario, representing the five terminal sire breeds in the study, were single-sire mated to ewes in the Lakeland College flock in August of 2006 and 2007. Every effort was made to acquire rams that were as unrelated as possible.

Lambs

Lambs were reared from birth until slaughter on the Lakeland College farm. After a period of 48-72 hours in a claiming pen, ewes and lambs were removed to one of several group pens, where the lambs remained until they were shipped to slaughter. Male lambs were castrated before leaving the claiming pens. Lambs were weaned when the youngest lamb in the pen was 42 days old. Ewes were removed to another facility and lambs left in the pens to which they were already accustomed. From one week of age until slaughter, lambs had ad libitum access to a total mixed ration pellet (16% CP) and long-stem grass hay. Lambs were weighed at weaning and every two weeks thereafter.

Lambs born in 2007 were killed on six dates from June 18th to September 11th. Lambs born in 2008 were killed on three dates from July 9th to August 27th. Live weights were taken two hours before transportation to Sunterra Meats, a journey of approximately four hours. At the processing plant, lambs were penned overnight with access to water and killed the next day, approximately 10 hours after arrival at the plant.

Processing

Hot carcass weights were recorded on all lambs after slaughter. Each carcass was graded by the same experienced grader; the GR measurement was taken at the 12th rib and a visual assessment for muscling at the leg, loin and shoulder was made. Carcasses were chilled overnight (approximately 15 hours) and processed the next morning.

From the cooler, each carcass was weighed on a cold weight scale, then cut and divided into three primal cuts: the shoulder, middle (rack and loin) and leg. Legs were further processed into tunnel-boned legs, middles into racks, short loins and Alta ribs, and shoulders into shanks and flat pack boneless shoulders. These cuts were trimmed for retail sale and the weight of each cut recorded. Excess fat was discarded until the ratio of lean to fat in the trim was 70:30, and the weight of the trim recorded for each lamb.

Data Set

Two hundred and sixty-three lambs born in 2007 and 327 lambs born in 2008 were available for a total of 590 lambs. The lambs were sired by terminal sires of the Canadian Arcott (125), Charollais (111), Ile de France (118), Suffolk (121) and Texel (115) breeds. Lambs were raised as twins (310) singles (177), or artificially (103).

The MIXED procedure of SAS was used in the analysis. The model for all traits contained the fixed effects of breed of sire, sex of lamb, type of rearing, and contemporary group (the year and the pen the lamb was reared in). The sire of the lamb (within sire breed) was included as a random effect.

Weaning weights were adjusted for the actual age of each lamb at weaning by the inclusion of weaning age in the model as a covariate. Lambs were sent to slaughter on the first weigh date when their live weight exceeded 50 kg. This weight was chosen so the college could market carcasses that were as heavy as possible without exceeding 27.3 kg, beyond which severe price penalties would be applied. Postweaning growth rate of the lambs was therefore evaluated as the age at which lambs reached slaughter weight. Because the lambs were not all slaughtered at exactly the same weight, the age at slaughter was adjusted for the lamb's actual slaughter weight by the inclusion of slaughter weight in the model as a covariate.

Carcass traits were adjusted to a common age at slaughter, live weight at slaughter or hot carcass weight by the inclusion of these traits (one at a time) as a covariate in the models for the carcass traits.

RESULTS

Breed of sire, sex or type of rearing differences presented below are significant at P<.05, unless otherwise indicated. Individual sire breeds or contrasts between pairs of sire breeds that are not specifically mentioned were not significantly different at this level.

Growth Traits

Least-squares means of weaning weight and age at slaughter are shown in Table 1.

- **Weaning weight**

The average lamb in this study was weaned at 48 days of age weighing 18.4 kg. Breed of sire was a significant source of variation in weaning weight adjusted to a common weaning age. CHR lambs had higher weaning weights than IDF or TXL lambs. Weaning weight was not significantly affected by the sex of the lamb. Weaning weights of lambs reared as singles (20.7 kg) were greater (P<.0001) than those of lambs reared as twins (17.9 kg), which were greater than those of artificially-reared lambs (15.8 kg).

- **Postweaning growth rate (age at slaughter)**

The average lamb in this study was slaughtered at 142 days of age at a live weight of 53.0 kg. Breed of sire was a highly significant (P<.0001) source of variation for age at a common slaughter weight. SUF lambs reached slaughter weight five days earlier than CAN or CHR lambs, ten days earlier than IDF P<.0001) lambs, and 16 days earlier than TXL (P<.0001) lambs. CAN and CHR lambs also reached slaughter weight earlier than IDF lambs. CAN (P<.0001), CHR (P<.0001) and IDF (P=.003) lambs reached slaughter weight earlier than TXL lambs. Male lambs went to slaughter 8.5 days earlier (P<.0001) than female lambs. Lambs reared as singles were slaughtered 5.6 days earlier (P=.0009) than lambs reared as twins, which were slaughtered 13.4 days earlier than artificially-reared lambs.

Table 1. Least-squares means of weaning weight and age at slaughter of lambs sired by five terminal sire breeds.

Sire Breed	Weaning Weight[1] (kg)	Age at Slaughter[2] (days)
Canadian Arcott	18.3[ab]	141.8[b]
Charollais	18.7[a]	142.2[b]
Ile de France	17.6[b]	147.3[c]

Suffolk	18.5[ab]	137.0[a]
Texel	17.6[b]	154.3[d]

[1] Adjusted to a common weaning age
[2] Adjusted to a common slaughter weight
[abcd] Means with different superscripts are significantly different (P<.05)

Carcass Grade Traits

Least-squares means for traits included in the determination of carcass grade for lambs are presented in Tables 2a and 2b. Hot and cold carcass weights were first adjusted to a common age at slaughter, and then to a common slaughter weight. The GR measurement and all carcass conformation traits were adjusted to a common hot carcass weight.

The average hot and cold carcass weights of all lambs were 24.4 kg and 23.9 kg.

Table 2a. Least-squares means of hot and cold carcass weights of lambs sired by five terminal sire breeds.

Sire Breed	Hot weight[1] (kg)	Cold weight[1] (kg)	Hot weight[2] (kg)	Cold weight[2] (kg)
Canadian Arcott	24.2[bc]	23.7[b]	24.3[b]	23.7[b]
Charollais	24.7[a]	24.2[a]	24.5[ab]	24.0[a]
Ile de France	24.6[ab]	24.1[a]	24.8[a]	24.3[a]
Suffolk	24.3[abc]	23.8[ab]	23.7[c]	23.3[c]
Texel	24.2[c]	23.7[b]	24.6[a]	24.1[a]

[1] Adjusted to a common age at slaughter
[2] Adjusted to a common slaughter weight
[abc] Means with different superscripts are significantly different (P<.05)

- **Hot and cold carcass weights adjusted to a common age at slaughter**

Breed of sire was a significant source of variation for both hot and cold weights, when adjusted to a common age at slaughter. CHR and IDF lambs had higher **hot** carcass weights than TXL lambs. CHR lambs were also superior to CAN lambs for this trait. The **cold** carcass weights of CHR and IDF lambs were significantly higher than those of CAN or TXL lambs. When adjusted to a common age at slaughter, male lambs had hot (P=.0006) and cold (P=.002) carcass weights that were 0.4 kg greater than those of female lambs.

- **Hot and cold carcass weights adjusted to a common slaughter weight (dressing percentage)**

Breed of sire was a highly significant (P<.0001) source of variation for both hot and cold weights, when adjusted to a common slaughter weight. SUF lambs had lower (P<.0001)

hot carcass weights than lambs sired by any of the other four terminal sire breeds. The **hot** carcass weights of IDF (P=.0002) and TXL rams were also greater than those of CAN lambs. IDF (P<.0001), TXL (P=.007) and CHR lambs had **cold** carcass weights that were greater than those of CAN lambs. Lambs sired by rams of the other terminal sire breeds had **cold** carcass weights that were greater (P<.0004) than those of SUF lambs. Hot and cold carcass weights of male and female lambs were not significantly different.

Table 2b. Least-squares means of GR measurement and carcass conformation scores of lambs sired by five terminal sire breeds.

Sire Breed	GR (mm)[1]	Leg[1]	Loin[1]	Shoulder[1]	Average[1]
Canadian Arcott	18.3[c]	3.2[b]	3.1[a]	3.0[a]	3.1[a]
Charollais	17.2[b]	3.3[a]	3.1[ab]	3.0[a]	3.1[a]
Ile de France	18.3[c]	3.4[a]	3.2[a]	3.0[a]	3.1[a]
Suffolk	16.0[a]	3.2[b]	3.0[b]	2.8[b]	3.0[b]
Texel	18.2[c]	3.3[a]	3.1[a]	3.1[a]	3.2[a]

[1]Adjusted to a common hot carcass weight
[abc]Means with different superscripts are significantly different (P<.05)

- **GR measurement and conformation scores adjusted to a common hot carcass weight**

Carcass GR measurement is a predictor of the yield of lean meat in a lamb carcass. Higher values indicate increasing levels of fatness in a carcass; lower values are desirable. The average carcass GR measurement of all lambs in this study was 17.6. Breed of sire was a significant (P<.0001) source of variation for carcass GR. SUF lambs had GR measurements that were significantly lower than those of CHR (P=.002) lambs, as well as those of TXL, CAN or IDF lambs (all P<.0001). CHR lambs had lower GR measurements than TXL (P=.004), CAN (P=.002) or IDF (P=.002) lambs. Male lambs (17.4) had lower GR measurements than did female lambs (17.9).

The average conformation scores over the leg, loin and shoulder in this study were 3.2, 3.1 and 3.0, respectively. Breed of sire was a significant source of variation for conformation scores over the leg (P=.0003), loin (P=.006) and shoulder (P<.0001), as well as for the average (P<.001) conformation score.

CAN and SUF lambs had leg conformation scores that were lower than those of IDF (P<.001), TXL (P<.01) or CHR rams.

IDF (P=.0003), CAN and TXL (P=.006) lambs had loin conformation scores that were superior to those of SUF lambs.

SUF lambs had lower shoulder conformation scores than lambs sired by any of the other terminal sire breeds (all P<.0001).

SUF lambs also had average conformation scores that were lower than those of TXL (P=.0002), IDF (P=.0003), CAN and CHR lambs.

Differences between conformation scores over the leg and the loin of males and females were very small (0.1) but significant. There was no significant difference between the sexes for conformation over the shoulder or for average conformation.

Retail Cuts

Least-squares means of the weights of the retail cuts from each of the five breed groups of lambs are presented in Table 3. Weights of retail cuts were adjusted to a common hot carcass weight during the analysis.

Table 3. Least-squares means of weights of retail cuts of lambs sired by five terminal sire breeds[1]

Sire Breed	Tunnel-boned Leg (kg)	Rack (kg)	Short Loin (kg)	Flat Pack Shoulder (kg)	Alta rib (kg)	Shank (kg)	Trim (kg)
Canadian Arcott	4.42[b]	1.50[a]	1.91[ab]	3.10[c]	1.37[a]	.75[b]	3.24[a]
Charollais	4.53[a]	1.48[ab]	1.93[a]	3.18[b]	1.36[a]	.74[b]	3.19[a]
Ile de France	4.63[a]	1.50[a]	1.87[b]	3.12[bc]	1.29[b]	.74[b]	3.19[a]
Suffolk	4.54[a]	1.46[b]	1.93[a]	3.15[bc]	1.35[a]	.79[a]	3.05[b]
Texel	4.62[a]	1.46[b]	1.78[c]	3.28[a]	1.37[a]	.75[b]	3.23[a]

[1]Weights of retail cuts adjusted to a common hot carcass weight
[abc]Means with different superscripts are significantly different (P<.05)

CAN lambs had tunnel-boned legs that were significantly lighter than those of IDF (P<.0001), TXL (P<.0001), SUF or CHR lambs. Tunnel-boned legs of female lambs (4.58 kg) were heavier than those of male lambs (4.52 kg).

CAN lambs had racks that were heavier than those SUF (P<.01) or TXL lambs. IDF lambs also had racks that were heavier than those of SUF or TXL lambs. There was no significant difference between the weights of racks of male and female lambs.

The short loins of TXL lambs were lighter than those of lambs sired by any of the other terminal sire breeds (all P<.0001). The short loins of CHR and SUF lambs were heavier than those of IDF lambs. There was no significant difference between male and female lambs for the weight of the short loin.

TXL lambs had heavier flat pack shoulders than SUF, IDF or CAN lambs (all P<.0001), as well as those of CHR (P=.003) lambs. Flat pack shoulders of CHR lambs were heavier than those of CAN lambs (P<.01). There was no significant difference between male and female lambs for the weight of the flat pack shoulders.

IDF lambs had lower Alta rib weights than CAN (P=.0017), TXL (P=.002), CHR (P=.005) or SUF rams. Female lambs (1.37 kg) had heavier (P=.009) Alta rib weights than did male lambs (1.33 kg).

SUF lambs had higher shank weights than CAN (P=.0004), TXL (P=.0017) CHR or IDF (both P<.0001) rams. Male lambs (.77 kg) had heavier (P<.0001) shank weights than did female lambs (.74 kg).

The weight of 70:30 lean:fat trim from each lamb was less for SUF lambs than for CHR (P=.0013), IDF (P=.0018), TXL or CAN (both P<.0001) lambs. There was no difference between male versus female lambs for 70:30 trim weight.

Discussion

The analysis of growth traits (weaning weight and age at slaughter) supports the expectation that lambs sired by larger breeds (SUF, CHR and CAN) will grow more rapidly and be heavier at a given age than lambs sired by smaller breeds (IDF and TXL).

However, the analysis of hot and cold carcass weights shows that this advantage in growth rate does not translate directly into heavier carcasses from these lambs.

The first two columns of Table 2a show the carcass weights that each breed cross would have had if all the lambs had been killed at exactly the same age. Given that the SUF, CHR and CAN lambs grew more quickly, it might have been expected that they would also have the heaviest carcass weights, but this is not the case. Although the TXL lambs (which reached slaughter weight later than any of the other breeds) had the lowest carcass weights in this analysis, the SUF lambs (which reached slaughter weight the earliest) had carcass weights that were intermediate and not significantly different from any of the other breeds.

The last two columns of Table 2a show the carcass weights that each breed cross would have had if all the lambs had been killed at exactly the same live weight. The breed crosses with the slowest growth rates (TXL and IDF) have higher dressing percentages and the breeds that grew faster (SUF, CAN, CHR) have lower dressing percentages.

The difference between the live weight of a lamb and its carcass weight depends on the weight of the hide and fleece (and contamination by mud and/or manure), the weight of the internal organs and gut fill, and the weight of the head and feet. Given that different breeds of lambs were raised together in the same pens, and that all were fasted for the same period of time prior to slaughter, it is assumed that they had similar amounts of mud, manure or gut fill. The lower dressing percentages of the SUF, CAN and CHR lambs may therefore be a result of differences in the weights of the hides, fleeces, internal organs, heads or feet. Alternatively, the higher dressing percentages of the IDF and TXL lambs may indicate that these lambs have more fat at a given weight. Unfortunately, the resources available for this study did not permit the dissection of each carcass into its components of muscle, fat and bone, which would have allowed for a more complete

interpretation of the carcass weight results. However, the GR measurement, which is available, does provide an indication of the relative fatness of each carcass.

The GR measurement is the total tissue depth 12 cm from the midline of the carcass over the last rib. Extensive research has confirmed its value as a predictor of the yield of lean meat in a carcass; higher values indicate higher fat and lower values are desirable. Examination of the first column of Table 2b shows that the SUF lambs (which had the lowest dressing percentage) also had the lowest GR measurements while the IDF lambs (which had the highest dressing percentage) had one of the highest GR measurements, along with the TXL and CAN lambs. It should be remembered however, that research has shown that purebred Texel lambs carry more of their total fat externally and less internally. The GR measurements of the TXL lambs may be overestimating the total amount of fat in their carcasses, relative to the other breeds.

IDF and TXL lambs were generally strong, and SUF lambs generally weak, for carcass conformation scores. These visual scores were borne out in some areas by the results of the analysis of the weights of the retail cuts, but not in others.

IDF and TXL lambs scored well on conformation of the leg and had superior weights of tunnel-boned legs. SUF lambs scored poorly for leg conformation and had also had lower tunnel-boned leg weights. TXL lambs had high shoulder conformation scores and also had the heaviest weights of flat-pack shoulders.

Conformation scores for the loin correspond more closely with the retail weights of the racks than with those of the short loins. IDF and CAN lambs were superior for both loin conformation and retail rack weight, CHR lambs were intermediate and SUF lambs inferior. TXL lambs had superior loin conformation scores but lower rack weights.

SUF and CHR lambs had higher short loin weights than their performance for loin conformation would suggest, and IDF and TXL lambs high loin conformation scores that were not supported by their short loin weights. The larger frame sizes of the SUF and CHR lambs may have yielded longer loins, which would be reflected in the weight of the retail cut, but may not have been taken into account in the visual appraisal of carcass conformation.

Although it is important for lamb processors to be able to predict the contribution that products such as the Alta rib, shank and trim will make toward the cost of purchasing and processing a lamb carcass, it is unlikely that decisions about sire breeds will be based on the yield of these. There were few significant differences between the five types of crossbred lambs for the weight of the Alta rib, shanks or trim. IDF lambs had lower Alta rib weights and SUF had higher shank weights, than the remaining breed groups. The weight of 70:30 trim from SUF lambs was also less than that from the other crossbred types.

CONCLUSION

The results of this study do not show a single breed cross with clear superiority for all of the partners in a lamb supply chain. The preferred terminal sire breed depends on who is making the choice.

Lamb producers (and feedlot operators) who sell live lambs may prefer the superior growth rate of lambs sired by Suffolk, Charollais and Canadian Arcott rams.

Lamb producers who market their lambs in a system where they are paid for a combination of hot weight, GR measurement and carcass conformation score may find it difficult to choose between the lower GR and the superior carcass conformation scores of the Ile de France or the Texel, but should be guided by the genetic makeup of their ewe flocks.

In flocks where lambs are frequently penalized for being overfat, the Suffolk may be the terminal sire of choice. In other flocks where lambs are already lean but may also be poorly muscled, Ile de France or Texel rams may be the best choice. It is also worth noting that the CHR lambs in this study were a good compromise between the low GR and poor conformation scores of the SUF lambs and the high GR and superior conformation scores of the IDF and TXL lambs.

If producers are shipping the majority of their lambs to a single processor, the processor may use incentives to encourage the production of lambs with higher dressing percentages (Ile de France, Texel) or improved weights of high-priced retail cuts such as the rack (Canadian, Ile de France, Charollais), short loin (Charollais, Suffolk, Canadian) or leg (Ile de France, Texel).

Purebred breeders reading this report may be accustomed to faster growth rates, higher dressing percentages and higher carcass conformation scores than those presented here for their breed of choice. It should be remembered that the lambs in this study had only 50% of their genes from the terminal sire breeds and the remaining 50% from a white-faced range breed (Rambouillet and/or Columbia). Results achieved on individual purebred operations may be diluted when crossbred lambs are produced under feeding and management conditions that are more typical of commercial lamb production than of specialized purebred flocks.

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SUPPORTIVE VALUE CHAIN SYNERGY

This project has been unique in its inclusion of key members of the lamb supply chain. The project has required intensive management and involvement by stakeholders. It has brought about a unique mind-set of collaboration, problem-solving and solution-finding for the betterment of the entire industry. This has created a shift from competition for limited returns to primary production and processing to a concerted effort to increase returns across the supply chain. It is important that this mind-shift be extended to the industry, first to key shippers to Sunterra Meats and then secondly to the industry as a whole. The Canadian lamb industry is small. With limited resources it must develop and utilize collaborative leadership.

The next project in the Building Better Lambs Initiative is underway. Through the Alberta Traceability Initiative funding has been provided for the Lamb Traceability Pilot project. Again Alberta Agriculture has provided project management and technical support. Key stakeholders are Alberta Agriculture, Sunterra Meats, Alberta Lamb Producers. Other co-operators are: Olds College, 10 co-operating farms and the Sunterra Farms lamb feedlot. Additional supporters are Shearwell Data Ltd (UK), Canadian Sheep Federation, Canadian Co-operative Woolgrowers. The Canadian Sheep Federation has applied for funding for a national pilot which is modelled on the Alberta Lamb Traceability Pilot and will include Saskatchewan, British Columbia and Manitoba in the first year.

The LTP project has undertaken an extensive training program for its stakeholders. It is critical that the lamb supply chain members have leading edge information and hands-on experience in new technology. A seventh training session is scheduled for February 2009. It is sponsored by the key stakeholder partnership, the George Morris Centre and the Canadian Sheep Federation. Its objective is to work with Sunterra's key shippers to improve communication and to build a more collaborative relationship to continue to

stabilize lamb supply, to extend knowledge on quality lamb production and to continue to develop tools, such as electronic systems, which enable the lamb supply chain to improve lamb quality.

Technology and Information Transfer

March 2008

- Advocacy & Communication Strategic Approaches – developed
- Survey 'key messages' – completed by stakeholder Steering Committee

January 2009

- Communication Committee formed with key stakeholder members: Randy Smith, Miles Kliner, Mel Mathison, Margaret Cook, Gordon Schroeder, Sue Hosford, Tracy Hagedorn
- Facilitator contracted to assist with development of 'Communication Plan'

February 2009

- Components of Communication Plan:

1. Research data analysis: Dr. Cathy Gallivan has completed final report. It's well written and will be basis for publications released to stakeholders and industry.
2. Animal models to be completed, will be the final genetic analysis for journal publication.
3. Analysis of impact of carcass information on producer and processor returns: Wade Meunier has completed first draft. This is under review and will be used to develop producer articles

- Decision not to proceed with video of project
- Decision to develop a presentation (possibly voice-over) for key stakeholders to use

March 2009

- Develop survey - ARD will compile a tentative list of survey questions.
- Communication Committee agree on a final version.
- Lakeland College software program for compiling data from electronic surveys.

April 2009

- Producer survey will be sent electronically by ALP / SSDB to producers in Alberta and Saskatchewan to assess base level of knowledge on the project and on communications about the project.

July 2009

- Producer session at Sunterra. Jointly sponsored by AB and SK stakeholders. Live and carcass demonstration and comparison between lambs from teminal sires and maternal sires.
- Demonstration of electronic grading and carcass reporting systems developed under the Lamb Traceability Pilot project.

October 2009

- Power point presentation completed for the Alberta and Saskatchewan Sheep Symposiums
- Copies to key stakeholders for use in their respective industry meetings, seminars

January 2010

- a second survey will be sent to the same list of producers to be used to assess the effectiveness of the Communication Plan
- Gaps will be identified to determine if additional information is required or if other research projects need to be considered.

Financial Summary
Total funding for project $33,000.00

Work yet to be completed.
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In conclusion:
We would like to thank you for your financial support, without your support we would not have been able to be a part of this project. It has been a huge project and there is still work to be completed. We feel this has been a successful project and will provide valuable information to our industry. If you have any further question please contact me at 1-306-933-5582 or email gordsheepdb@sasktel.net
Thank you